International Journal of Electrical Engineering and Technology (IJEET)
Volume 11, Issue 8, October 2020, pp. 147-159, Article ID: IJEET_11_08_014
Available online at https://iaeme.com/Home/issue/IJEET?Volume=11&Issue=10
ISSN Print: 0976-6545 and ISSN Online: 0976-6553
https://doi.org/10.34218/IJEET.11.8.2020.014

THE EFFECTIVE LEARNING APPROACH TO BLENDED LEARNING AND ICT - TPACK METHODS

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ABSTRACT

Blended learning is an innovative concept that combines the advantages of traditional classroom learning and ICT-based learning, including offline learning and online learning and TPACK pedagogical methods. The opportunity to study together; constructive learning and computer-based learning (CAI). Blended learning requires a lot of effort, the right attitude, an attractive budget and highly motivated teachers and students to implement it successfully. Since it contains different modes, it is a difficult task, and it is also a difficult task to organize. This article analyses the concept of blended learning, it's essential characteristics and implementation requirements. The level of blended learning in the Indian education system was also discussed. The present article also tries to explain this survey and the awareness of blended learning methods.

Keywords: ICT- TPACK, Blended Learning, Computer Based Learning

Cite this Article: T. Saravanan, N. Nagadeepa and B. Mukunthan, The Effective Learning Approach to Blended Learning and ICT - TPACK Methods, *International Journal of Electrical Engineering and Technology (IJEET)*, 11(8), 2020, pp. 147-159.
https://iaeme.com/Home/issue/IJEET?Volume=11&Issue=10

1. INTRODUCTION

ICT generally encompasses those technologies that are used to evaluate, collect, manipulate, and disseminate information. These include multimedia, teleconferencing, video conferencing, web conferencing, learning management systems and community mobile learning methods. ICT4D Information and Communication Technology for Development is about using IT tools to eradicate poverty and illiteracy and help disadvantaged sectors of the community.

The Technological Pedagogical Content Knowledge (TPACK) is an emerging theoretical framework that is increasingly used to demonstrate how teachers can incorporate Information and Communication Technology (ICT) into the teaching of subjects. The framework assumes that effective technology integration for the delivery of specific content or the subject requires

understanding and negotiating the relationships between these three components: technology, pedagogy, and content. The TPACK to design Teacher Professional Development Activities (TPD) and these studies have confirmed its effectiveness in improving teacher skills. The latest scientists called for a change in the use of the framework for the design of TEL environments with a holistic consideration of pedagogy and topics. To date, however, there is only one study that has used the framework to design an environment for learning software development among students.

2. BLENDED LEARNING

It is a teaching method, teaching and learning method that combines classroom teaching methods with computerized activities to teach courses. This teaching method means that the combination and integration of face-to-face and online courses and learning tools offers the best opportunity for an effective learning process. Blended learning is a term for educational practice that combines digital learning tools with face-to-face teaching in a more traditional classroom. In a true blended learning environment, students and teachers need to be in the same room. In any case, the digital tools used should be able to be used by learners to control the speed or learning topics.

The Flipped course encourages students to access digital teaching materials in their free time via a cloud-based learning platform.

The features of Blended Learning (hereafter referred to as BL) environment are:

- Increased student engagement in learning.
- Improved interaction between teachers and students.
- Responsibility for learning.
- Time management and flexibility
- Improved student learning outcomes
- Enhanced institutional reputation.
- More flexible teaching and learning environment
- More accessible for self and continuous learning
- Better opportunities for experiential learning

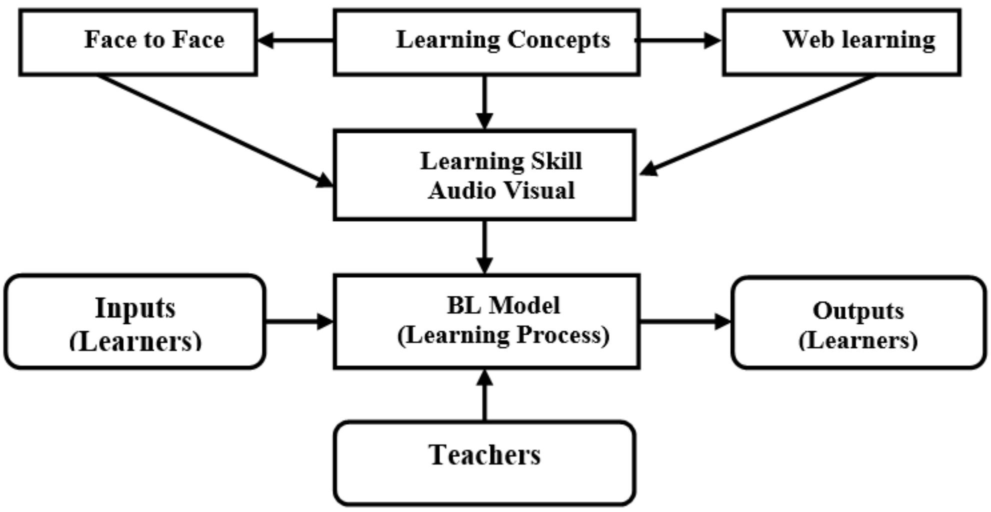

Figure 1 BL Framework

2.1. BL Structures in Education

There are many factors to consider when choosing the combination of face-to-face and online teaching and learning activities. In some cases, most student-teacher interactions and direct teaching take place in the classroom, while materials and possibly some additional activities are delivered online. In other cases, most classroom activities take place online, with infrequent face-to-face meetings to solve problems and help community building. In some hybrid systems, students can choose which tasks to do online and which to do in class. These are called a la carte models. Ideally, the design of the combination should allow each student to get the combination that best suits their age, living conditions and learning needs. The most important thing is to ensure that learners can function like learners in any teaching method. Single or mixed mode, even if that's not their preference or the best situation for them. These examples of BL are drawn from higher education but can be shaped to fit any teaching and learning situation.

2.2. Blended Face-to-Face Class

Sometimes it is called the face-to-face driver model, which is based on the model that is based in the classroom, although much of the class time has been replaced with online courses. This model requires sitting times and online activities are used as an add-on. Face-to-face learning: Reading, quizzes, or other assessments are conducted online at home. This model allows students and teachers to share more valuable study time as class time is used for advanced learning activities such as group discussions and projects.

2.3. Blended Online Class

This class, sometimes referred to as online controller mode, is the opposite of the immediate hybrid class. The courses mostly take place online, but there are also a few personally necessary activities such as lectures or laboratory work.

2.4. The Flipped Classroom

The classroom is changing the traditional classroom structure of listening to lectures and doing homework at home. Students in the classroom watch short videos of online lectures and then enter the classroom for group assignments, projects, or other activities. The classroom model is a sub-model of the blended face-to-face or blended e-learning class.

2.5. The Rotation Models

In this model, students can switch between different learning forms in the course, one of which is online learning. There are different types of sub-modes: room rotation, laboratory rotation and personal rotation. Some of these sub-models are more suitable for school teaching; rotation of stations, for example, requires students to rotate between stations in the classroom at an instructor's discretion. Others perform well on university campuses; for example, the laboratory rotation model requires students used to change the campus location (at least one of which is an online learning laboratory).

3. TPACK FRAMEWORK

The TPACK is a new digital tool of teaching and learning methods. This TPACK model, created by educational researchers Mishra and Kohler (2006), TPACK mainly focus on *what* you teach and *how* you teach must be the basis for any new educational technology like Google classroom, WPS, etc. that plan to use in classroom to enhance learning.

The TPACK is a powerful principle for almost 12 years because the complex constituents described above allow room for a range of specific educational technology. Any effective

implementation of technology in the classroom requires acknowledgement of the dynamic, transnational relationship among content, pedagogy, and the new entry technologies, all of which are in the unique context of different universities and schools, classrooms, and cultures. Individual educators, specific classes, class demographics and other factors and more will mean that every situation will demand a slightly different approach to educational technology integration. No one monolithic combination of content, pedagogy, and educational technology will be applicable for every setting and TPACK leaves room for researchers and practitioners to adapt its framework to different environment. TPACK gives us three knowledge areas to consider: Technology, Pedagogy, and Content Knowledge.

3.1. The Evolution of the TPACK Model

TPACK gives us three areas of knowledge to consider: technology, pedagogy, and content knowledge. Arranging these three categories on a Venn diagram (figure 1) helps us see the four areas that are created in Mishra and Koehler's framework.

3.2. Impact of Teaching and Learning

The technology is treated as if it were separate from teaching and learning. We have professional development workshops that teach us how to use a particular software or app, and how we fit it into our classroom is not discussed. Mishra and Koehler point out that it is currently a negative influence. They claim that TPACK's lack of awareness keeps technology separate and creates four problems with using technology in the classroom. First, technology changes are so rapid that it is extremely difficult to keep up with the latest developments and apps. The second problem is that software is designed for business, not education. This often means that students are learning to use the program, not the content of the class. The third problem with the separation of technology is the situational nature of the classroom. A teacher can customize a lesson to ensure that it meets the needs of the specific group of students, but the instructional video cannot. It's the same video every time it plays. In conclusion, Mishra and Koehler say that the separation of technology places an emphasis on what is not how. From a teacher's perspective, it's about what technology we're going to be using today, what it says, what skills it requires, rather than how I can teach my students.

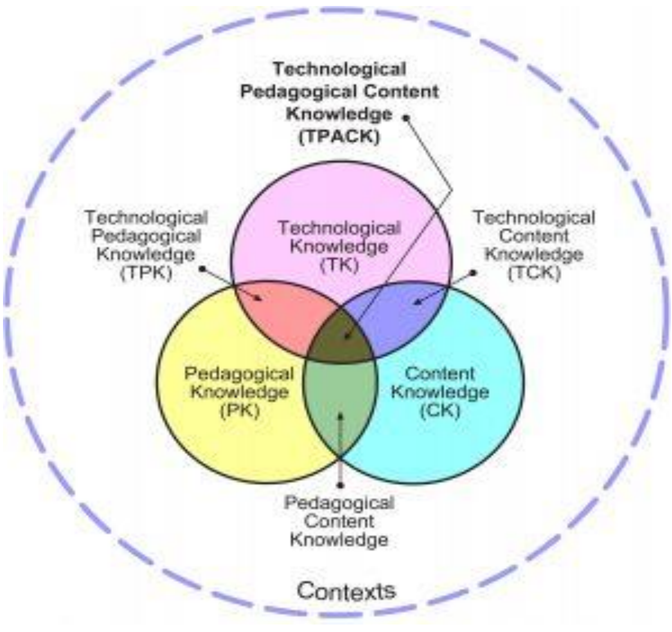

Figure 2 TPACK Framework

3.3. ICT-TPACK Classroom

The technology as a separate knowledge package creates problems, but if we understand the framework of TPACK we can incorporate technology into the content and pedagogy of our classrooms. Integration will help our students learn more effectively. Mishra and Koehler suggest that TPACK should lead curriculum development and teacher training. Now, to apply TPACK to our classrooms, Judith B. Harris and Mark J. Hofer worked with colleagues from universities in the United States to create activity types. Instructional Planning Using Curriculum-Based Activity Type Taxonomies explains how TPACK should transform the way we plan our daily teaching. They describe a planning process in which we first select the learning outcomes that we will work on that day or during this lesson. The learning outcomes are the content. The second suggested step is to choose an activity type. The activity type is pedagogy or how will students learn the content. Finally, we can choose technologies that support the type of activity and help students learn. Harris, Hofer, and their colleagues show us, example by example, how our lesson planning should incorporate every part of the TPACK framework, allowing us to create and develop the overlapping knowledge to create the best learning environment for our students. The simplest idea at TPACK is that a person who is a world-renowned expert in a subject may not be a great teacher because they lack the pedagogical knowledge to make the subject accessible and understandable. To be a great teacher, we need to combine our knowledge of the subject with our knowledge of the classroom. With the increasing focus on technology, we also need to learn to combine technology with our content and pedagogy to create an effective learning environment.

3.4. The ICT-TPACK Skills Tools

This instrument consists of two parts, the ICT-TPACK skills test and the ICT-TPACK skills questionnaire. The ICT-TPACK Skills test is a performance achievement scale that is used to measure students' specific technical skills at the beginning and at the end of the intervention. This test was designed by the researcher and consists of six questions that measure various skills, such as using the operating system and using the Microsoft Office suite, the Internet, Adobe Photoshop CC and multimedia editing software. The test was verified by an educational technology expert and the test confidence was 0.85. The ICT Skills Questionnaire in self-assessment measure and was created by combining two existing instruments: the national survey on information technology in teacher training by Milken Exchange on Educational Technology (1999) and the Technology Proficiency Self-Assessment (TPSA) by Ropp (1999).

The researcher added a few items to assess more advanced ICT skills, such as video conferencing, multimedia production, and simulations. The questionnaire has two main scales: things that participants can do in the study location on a computer system and things that participants can safely do on a computer system. A factor analysis was performed which resulted in two subscales for each scale. The subscales basic skills and advanced students emerged from the first scale. The number of items on each subscale was 7 and 3, and the Cronbach's alpha values were 0.86 and 0.87, respectively. And the subscales ICT multimedia tools and online educational platforms, e-mail and the Internet emerged from the second scale. There were seven items on each subscale and the Cronbach's alpha values were 0.83 and 0.84, respectively.

3.5. Interviews with Blended Support

A semi-structured interview for all the DTs was used to see how the experimental was valued. This instrument was divided into two parts: the first part dealt with teams that experienced the experimental group. The questions for these teams were:

- Did you like the mixed approach during this course?

- Are you satisfied with the support given during the blended approach in this course?
- Would you like to experience or apply this approach again?
- Do you think the blended approach was helpful? Why?

3.6. ICT-TPACK Reflection Questions

At the end of the course, the students were asked to two TPACK questions:

- What do we mean by TPACK?
- Describe the situation where you effectively could combine the content with ICT and a specific teaching approach in a classroom lesson. Please include in your answer a description of the content, objectives, target group, teaching approaches, ICT, and teachers' and students' roles in relation to ICT.

These questions were meant to assess students' understanding of TPACK and whether they could relate TPACK to their practice or experience during their in-school training, or within their preparation program.

4. SCOPE OF STUDY

This study contributes to an understanding of the use of technology by science teachers to design courses based on ICT knowledge and through a blended learning approach. For the dimensions of ICT knowledge according to the TPACK framework developed by Koehler and Mishra (2006), only the four technology-related dimensions proposed by Graham (2009) were used. The blended learning approach to teachers' professional development is aimed at addressing existing gaps in teacher preparation programs. However, there is relatively limited empirical evidence on the blended learning approach in teacher training programs, and they indicated that more empirical research is needed to examine the effectiveness of blended learning in teacher training programs. Specifically, the present study examined the dimensions of ICT knowledge according to TPACK regarding the design of e-courses and the effectiveness of blended learning on the professional development of science teachers.

4.1. Research Questions

For this study, the following research questions were examined:

RQ1: What is the level of awareness among teachers on the TPACK scale for the integration of ICT into the design of e-courses after the intervention?

RQ2: Do the control group and the experimental group for learning have a different influence on the development of TPACK by teachers and on their attitudes and skills about ICT?

RQ3: How do teachers experience blended learning for learning?

5. METHODOLOGY

5.1. Study Design

The present study is of a quasi-experimental nature, using a non-equivalent group design before and after the test. The groups are as follows: Experimental group that trained the teachers in which a blended learning and TPACK environment was provided; Control group in which the teachers were trained where the traditional learning environment is offered.

5.2. Participants

The participants in this study were 98 teachers from the science teacher preparation program. All of the students were registered in the "Educational Seminar" course with two instructors. The "Educational Seminar" course was accompanied by an in-school field training in the final

semester of the educational program. All teachers an average age of 23 to 30 years. The participants had science either as their major or minor specialisation. Almost all of the participants had a computer at home and about 96% of the participants indicated that they had an Internet connection at home. About 88% of the participants indicated that they had access to a computer at the department, and 73% of the participants indicated that they had Internet access at their department.

5.3. Intervention

This research uses a flexible blended learning model; This model has an online platform that offers most of the courses. The face-to-face courses include 25 computer courses in the classroom and the online training courses include 30 courses (asynchronous and synchronous). The exercise program lasted about 12 weeks, 4 days a week, a total of 55-time segments, each time segment was 2 hours.

Table 1 Blended Instruction Model

Time allocation for training program processes	
Process	**Session**
ICT based teaching (discussion, feedback, workshop) Computer assisted instruction	25
Online learning Asynchronous (e-mail, discussion, forum, Facebook) Synchronous (chat, video, audio conference live in website)	30
Total	55

5.4. Control Group

The control group consisted of 55 classrooms and computer courses, and tasks were assigned and discussed with the trainer.

5.5. Experimental Group

Use online platforms, ICT training tools, CD-ROMs and PowerPoint presentations for experiments and computer instructions. In the online platform, the navigation contained the sequential elements.

5.6. Sampling

The sample includes 20 computer science teachers (30 per person) in the control group and the experimental group. These groups are tailored to the level of computer and Internet usage indicated by the teacher in the introduction to continuing education. After matching, the subjects were randomly assigned to the experimental group and the control group.

5.7. The TPACK Survey

The TPACK survey was used at the beginning and at the end of the intervention. This instrument uses a five-point Likert scale: 1) strongly disagree, 2) disagree, 3) Undecided, 4) agree, and 5) fully agree. The items contained in this instrument measure the self-assessments of teachers in the TPACK areas. The data from the survey was used to measure a perceived change in TPACK.

5.8. Data Analysis

Means and standard deviations were calculated for the TPACK survey, attitudes towards the ICT questionnaire and the ICT skill tools test / survey. A t-test was used to compare the difference between the pre-tests and post-tests, as well as control group and experimental group

measurements. If the t-test result was significant, the effect size (Cohen's d) was calculated to give an indication of the size of the effect. Cohen (1988) provided preliminary benchmarks for interpreting the effect sizes: d = 0.2 small, d = 0.5 medium, and d = 0.8 large effect sizes. The data from the TPACK reflection questions were analysed using the TPACK reflection rubric.

6. RESULTS

6.1. Development of knowledge, skills and attitude toward ICT while working in DTs

Table 2 Comparison of the teachers' perception of their TPACK

Factors	Pre-Test	Post-Test	P (level of significance)	Effect size
TK	3.26	3.92	0.0002	1.5
CK	3.64	4.23	0.0002	1.06
PK	3.76	4.39	0.0002	1.7
PCK	3.68	4.36	0.0002	1.4
TCK	3.30	4.36	0.0002	2.1
TPK	3.10	4.36	0.0002	3.1
TPACK	3.05	4.25	0.0002	2.9

Notes: 1 = Strongly disagree (SD); 2 = Disagree (D); 3 = Undecided (U); 4 = Agree (A); 5 = Strongly agree (SA)

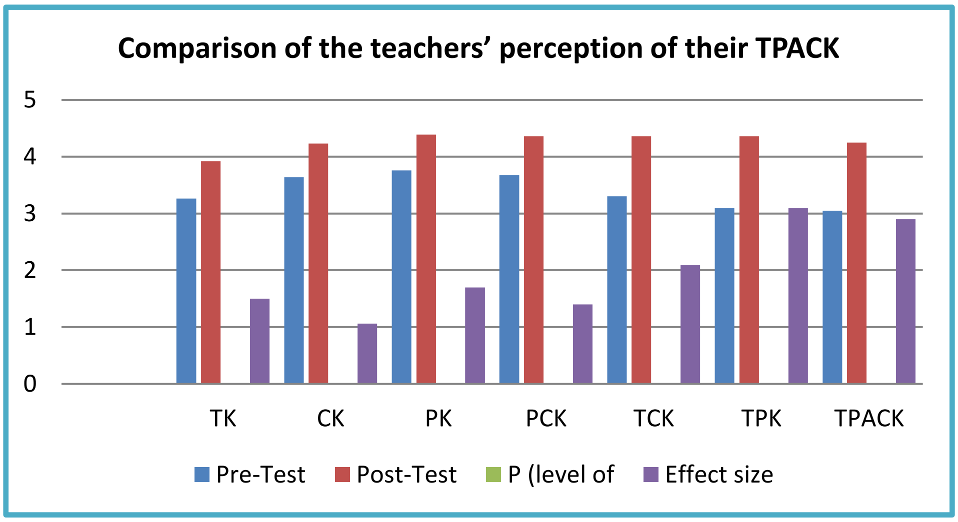

Figure 3

The results of the TPACK survey are summarized in Table 2. The results showed that respondents reported significant advances in the various domains of knowledge related to the TPACK framework, with a large effect size when comparing the post and pre-test data.

Table 3 summarizes the results of both the ICT competence test and the ICT survey. The results of the ICT competence test showed a significant increase in student scores with a large effect size (d = 1.99). The results of the ICT competence survey showed a significant difference at the end of the intervention on the scales related to the basic ICT skills with a medium effect size (d = 0.60) and for multimedia tools as well as e-mail and the Internet, with a large effect size for both (d = 2.09 and d = 0.80). However, there was no significant difference in advanced ICT skills.

Table 3 Comparison of teachers' pre and post ICT skills

		Pre-Test	Post-Test	P (level of significance)	Effect Size
ICT skill test score		7.85	13.99	0.0002	2.09
Minimum (0) – Maximum score (20)		3-15	7-19		
ICT skills questionnaire					
Thing's teachers do on a computer at school	Basic skills	3.60	3.80	0.0002	0.80
	Advanced skills	2.81	2.79	1.000	-
Thing's teachers feel confident to do	Multimedia tools	3.20	3.88	0.0002	1.65
	Email and Internet	3.85	4.45	0.0002	1.06

Notes: 1 = Strongly disagree (SD); 2 = Disagree (D); 3 = Undecided (U); 4 = Agree (A); 5 = Strongly agree (SA)

Table 4 Comparison of the teachers' pre and post attitude toward ICT

Factors	Pre-Test	Post-Test	P (level of significance)	Effect Size
Instructional and productivity tool	3.98	4.70	0.0002	1.30
Enjoyment	4.02	4.35	0.0002	0.90
Anxiety and frustration	2.78	2.50	0.0002	0.69

Notes: 1 = Strongly disagree (SD); 2 = Disagree (D); 3 = Undecided (U); 4 = Agree (A); 5 = Strongly agree (SA)

Participants' attitudes towards ICT are summarized in Table 4. The results showed a significant increase in ICT as a tool for teaching, productivity, and enjoyment. The effect size was medium for pleasure (d = 1.30) and for the teaching and productivity instrument large (d = 0.90). At the end of the intervention, fear and frustration were significantly reduced with a medium effect size (d = 0.69).

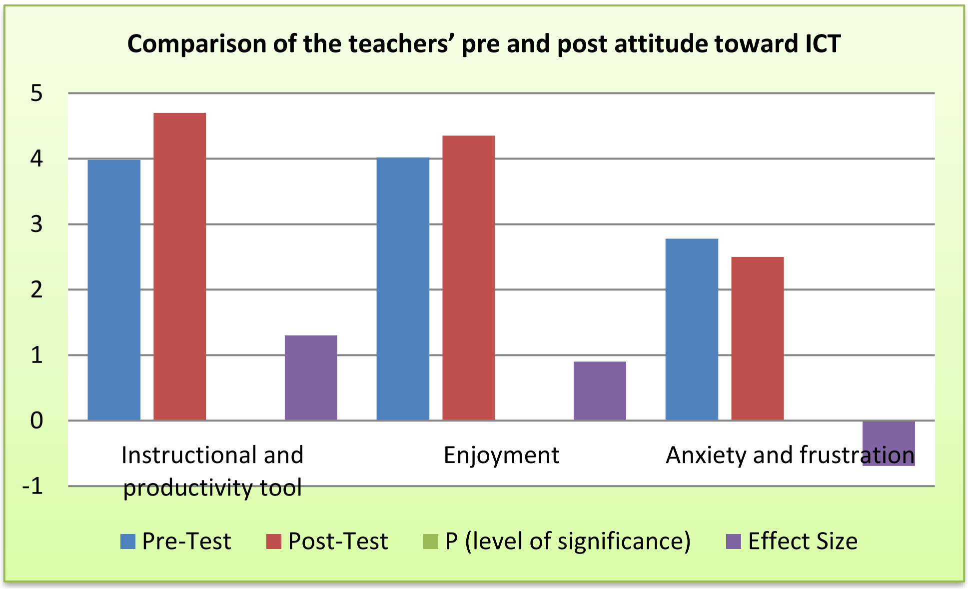

Figure 4

6.2. To Change in TPACK Skills and attitude toward ICT

The results of the increase in different knowledge regarding TPACK for the experimental group condition and the experimental group condition are summarized in Table 5. The gains for the various knowledge domains for the respondents in the experimental group condition were higher for all factors except PCK. However, only the increases in TK and TPK were significant (p = 0.52 and p = 1.02) with a medium effect size (d = 0.85 and d = 0.96).

Table 5 Comparison of the change in TPACK (post – pre) in Control and Experimental groups

Factors	Pre-Test	Post-Test	P (level of significance)	Effect size
Change in TK	0.52	0.88	0.032	0.85
Change in CK	0.67	0.77	0.889	
Change in PK	0.68	0.81	0.638	
Change in PCK	0.86	1.23	0.459	
Change in TCK	0.98	1.35	0.045	
Change in TPK	1.02	1.45	0.65	0.96
Change in TPACK	1.37	1.33	0.924	

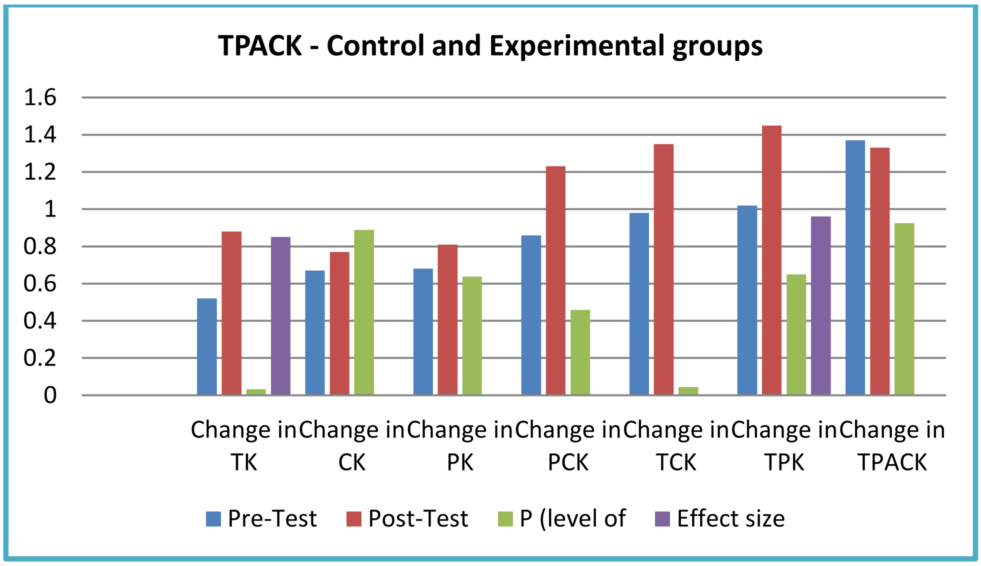

Figure 5

The results of the open questions on the TPACK definition and examples are shown in Table 6. Participants in the experimental group condition were able to define the TPACK framework significantly better than the participants in the control group condition (p = 0.0002) with a large effect size (d = 1.33). The participants in the control group condition also performed significantly better than the participants in the control group condition with a large effect size (d = 1.80) in their description of a situation in which they can use TPACK (p = 0.0002).

Table 6 Comparison of TPACK reflection question for control and experimental groups

Questions	Control group	Experimental group	P (level of significance)	Effect size
TPACK definition	58.7	80.4	0.0002	1.33
TPACK example	57.9	85.4	0.0002	1.80

Note: the score is out of 100

6.3. Blended Support Experience of the Teachers

The team's log showed that the experimental condition group was trying to resolve their ICT-related problems directly through the online support environment. Most of the teams in the trial state asked to meet the experts about design principles or the progress of their product. The experimental condition group rarely asked about ICT-related skills. In addition to the test condition questions, the control condition teams also asked questions about ICT-related technical skills. In general, the problems raised by the teams mainly concerned the technical aspect of the TPACK framework: TK, TPK, TCK and TPACK, but had relation to other aspects of TPACK: PK, CK and PCK, as was also determined in the previous study.

Looking at the results of the interview with the experimental teams, all teams indicated that they enjoyed their experience with the experimental approach and that they would like to have this experience throughout the program. They found the online environment helpful and gave several reasons for it. One team stated that this type of support saved them time and effort as they didn't have to wait to meet with the experts to ask for an explanation or solution. Another team argued that this approach made them less dependent on the teacher. They could solve their problems directly anytime, anywhere, anytime. In addition, various teams argued that the experimental condition made them familiar with ICT tools while they were working and accessing online support. Some teams also stated that providing examples of lesson plans that incorporate ICT and the use of various ICT applications in science lessons gives them a deeper understanding of integrating ICT into science lessons and gives them the opportunity to learn about ICT thinking differently about science education compared to the way they use ICT in their daily lives. They also addressed the importance of the discussion forums available through the site to share their ideas with peers and various experts to gain a deeper understanding of any issues related to the design or course.

Looking at the responses of the control condition in the interview after the visit and exploring the online support environment, almost all control teams were upset that they did not have access to the online support environment during the intervention and they stated that, if they were allowed to use it during the intervention, they would have had higher results and their product would be better. They confirmed that this type of support with the availability of control should be used simultaneously and not alone, as they still needed the instructor to guide them in their personal environment, as some teams made clear.

7. DISCUSSION AND CONCLUSION

The purpose of this study was to investigate whether providing mixed support is an efficient alternative to assisting TPACK development with pre-school science teachers while they are working in DTs as part of the Applied Education Authority's Science Teacher Preparation Program, and training in India. In addition, we wanted to confirm the findings from the previous study that working in DTs on the design of ICT-based teaching is a promising avenue for the development of TPACK in science student teachers. This study confirmed the results of our previous study that working in design teams had a positive impact on the development of TPACK by teachers. We found that students felt that working in DTs led to the development of all domains related to TPACK. We also found that trainee teachers gained more ICT skills and attitudes towards ICT. This suggests that teachers have become more ICT literate and probably more confident in using ICT in class. From these results we conclude that working in DTs could indeed be a suitable approach to develop TPACK for effective ICT integration. Our results are comparable to other studies that use an approach where teachers work together to develop an ICT-based solution to authentic educational problems.

Under the condition of blended support, the results showed even higher gains in attitudes towards ICT, technological knowledge, and technology pedagogical knowledge. No differences

were found in terms of fear and frustration with computers, ICT skills (test and survey) and other aspects of TPACK except for TK and TPK. Compared to the control group, the test groups' attitude towards computers as a teaching and productivity tool and their enjoyment of working with ICT tools were higher.

The results of this study are relevant findings, especially in the Kuwaiti context, where traditional teaching methods with teacher-cantered approaches still predominate. The use of technology in education in this context is already an educational reform, the use of a mixed support approach is a second and perhaps even more difficult innovation. About this context-specificity, we would like to explain some findings on the blended support approach, but also on the measures used.

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